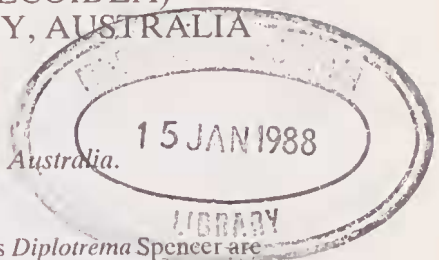


TWO NEW ACANTHODRILINE EARTHWORMS (OLIGOCHAETA: MEGASCOLECOIDEA) FROM THE NORTHERN TERRITORY, AUSTRALIA

G.R. DYNE

Bureau of Flora and Fauna,
GPO Box 1383, Canberra, ACT 2601, Australia.



ABSTRACT

Two new species of the acanthodriline earthworm genus *Diploctrema* Spencer are described from the Northern Territory and shown to have affinities with the *D. shandi* species-group. The larger of the two species is associated with the production of unusual casts, which are amongst the largest recorded for earthworms. Both species are apparently geophagous, which, together with presumed amphibious propensities, contributes to their ability to survive in the climatic extremes of the wet/dry tropics.

KEYWORDS: Oligochaeta, Megascolecidae, Acanthodrilinae, earthworms, wormcasts, monsoonal adaptations.

INTRODUCTION

A previously unknown earthworm fauna was reported from the Northern Territory by Jamieson and Dyne (1976). The predominant taxon, *Microscolex* (*Diploctrema*) Spencer, was noted in the same work as having an essentially northern distribution in Australia, although the exact extent of the generic domain was not known at that time. More recent studies (Dyne 1978, 1984) have demonstrated a prolific eastern Australian acanthodrilic fauna, with a southerly limit near Narrabri (northern NSW). The extent of the generic distribution in the northwest of the continent has yet to be satisfactorily investigated. There is also an apparent distributional hiatus across the Gulf of Carpentaria, such that the eastern Australian and northern Australian components of the fauna have discontinuous ranges. This may, however, prove to be an artefact of low collecting effort in the Gulf region.

Recognized by Jamieson (1974a) as a subgenus of *Microscolex*, *Diploctrema* Spencer is herein re-elevated to generic rank to signify its geographical and morphological identity, separate from that of the South American and trans-subantarctic *Microscolex*.

ABBREVIATIONS USED IN THE TEXT AND FIGURES

| | |
|-------|-----------------|
| gen.m | genital marking |
| H | holotype |
| l | length |

| | |
|------|-----------------------------------|
| NTM | Northern Territory Museum, Darwin |
| P | paratype |
| pr.p | prostatic pore |
| s | number of segments |
| sp.p | spermathecal pore |
| U | circumference |
| w | diameter |

The descriptive format largely follows that established by Jamieson (1974b).

SYSTEMATICS

Diploctrema planumfluvialis sp.nov. (Figs 1,2,4-6)

Type material. HOLOTYPE - NTM Wo1, Upper Adelaide River Experimental Station, Adelaide River Floodplain, 131°14'E, 13°05'S, Northern Territory, solodic (Dy3.63) soil, collector B. Wood, 8 March 1984. PARATYPES - NTM Wo 2-5, 4 clitellate individuals, data as in holotype.

Additional material. Semimature specimens and some fragments, data as in type material (author's collection).

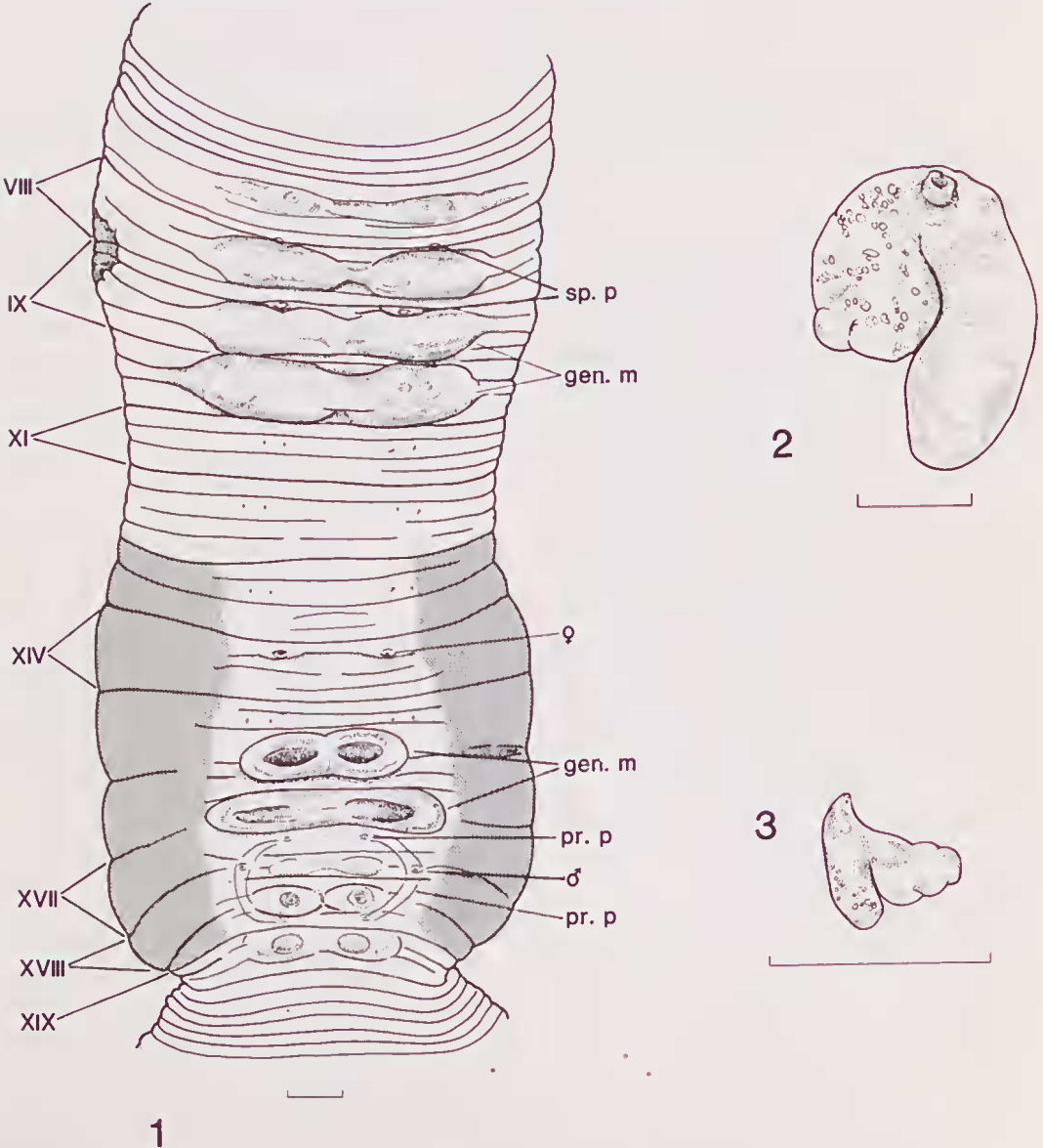
External anatomy. 1=192, 145 mm; w=8.6, 6.4 mm; s=255, 266 (H, P2). Whitish-grey in alcohol, clitellum orange-pink. Prostomium proepilobous, peristomium longitudinally creased. First perforate dorsal pore 11/12. Setae in regular rows throughout, ventral setal pairs lacking in XVIII, modified as penial setae in XVII and XIX. Penial setae present, genital setae lacking. Nephropores not externally recognizable.

Clitellum saddle-shaped, skirting the venter well lateral of *b*-lines, extending from mid-XII (weak) to mid-XIX; thickly tumid, obscuring all other external features save the intersegmental furrows.

Male pores seen as minute orifices, lateral of *b*-lines, at 17/18, just medially to the edge of a pair of broad, shallow seminal grooves that link the porophores. The latter are poorly defined, ?coincident with *b*-setae, and scarcely elevated, on minute papillae.

Female pores somewhat disguised by the development of glandular tumescence in XIV, located presetally in mid-*ab*. Small spermathecal pores, hidden by tumid pads, present in *a*-lines in 7/8, 8/9.

Accessory markings. Four conspicuous, broad tumid bands almost cover the ventral surface of segments VII-X, the anteriormost marking the least well-developed, those on VIII and IX subequal, that on X the most extensive (all mature specimens). Though



Figs 1-3. *Diplostrema* spp., holotypes: 1, genital field of *D. planumfluvialis*; 2, right IX spermatheca of *D. planumfluvialis*; 3, right IX spermatheca of *D. socialis*. Scale lines 1mm. Abbreviations in text.

these markings resemble the tumescences associated with genital seta follicles in other species, such follicles are lacking. Segment IV has a glandular appearance in H, with a well-developed bipartite marking present in 14/15 in P1. A pair of oculate markings (elevated rims surrounding a circular concave area) present intersegmentally in 15/16 on H, P1, (on P2 present as a single, midventral marking) and in 16/17, where the eyelike markings are most widely separated than in the latter intersegment, on all mature specimens. Ill-defined glandular markings in 17/18 and 19/20 (all specimens, best developed in P3). Small, closely paired oculate markings also present in 19/20 on all mature specimens. Interscgment 20/21 a single, midventral oculate marking on P1, P2.

Internal anatomy. Septa 5/6-6/7 moderately thickened, 7/8-9/10 fairly strongly muscularized, 8/9 perhaps the thickest, 10/11-11/12 moderately thickened, remainder thin. Dorsal blood vessel single, traceable anteriorly to the pharynx; last hearts in XIII. A supra-oesophageal vessel is present in VIII-XIV. In X-XIII, the commissurals appear to communicate only with the supra-oesophageal vessel, but with the anterior diminution of the latter, the connectives (from IX anteriorly) become associated with the dorsal vessel. Gizzard moderately developed, globose and readily compressed, in V. Oesophagus broad and vascular, particularly in posteriormost section, but narrowing immediately before commencement of intestine, in XVIII. No distinct calciferous glands present. Typhlosole absent. Ingesta: soil particles only (no recognizable organic remains).

Small-medium sized iridescent spermatid funnels present in X and XI, and large acinous seminal vesicles present in XI and XII. Prostate glands consist of a tubular, compactly coiled glandular portion, restricted to segment of origin, or, in the case of the anterior organs only, rarely extending partially into the succeeding segment; anterior prostatic pairs are more than twice the size of the posterior organs. Prostatic ducts short and non-muscular. Penial seta follicles contain several setae, some reddish in appearance, associated with the prostatic ducts. Setae gently curving, ornamented over the distal half with regularly arranged depres-

sions which appear as jagged excavations, and approximately 2 mm in length when mature.

Ovaries consist of delicate, flattened webs of connective tissue with embedded oocytes; these and medium-sized iridescent oviducal funnels present in XIII, ovisacs absent. Spermathecae 2 pairs, each composed of a short duct, tubulo-digitiform ampulla, and sessile, sacciform diverticulum, the latter filled with numerous iridescent sperm locules. Length right IX spermatheca = 3.1 mm. Genital setae or associated glands absent.

Remarks. The new species has affinities with the widespread *D. shandi* Jamieson and Dyne, agreeing in the overall construction of the spermathecae, ornamentation of the penial setae, position of the seminal vesicles, and arrangement of the blood vascular system. *D. planumfluvialis* is distinctive, however, in having the prostatic glands almost always restricted to their segments or origin, an abbreviated condition, which elsewhere in the Northern Territory is only seen in two very small species. The appearance of the genital field is also diagnostic.

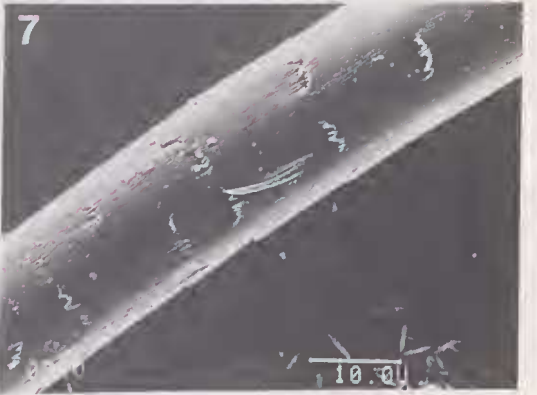
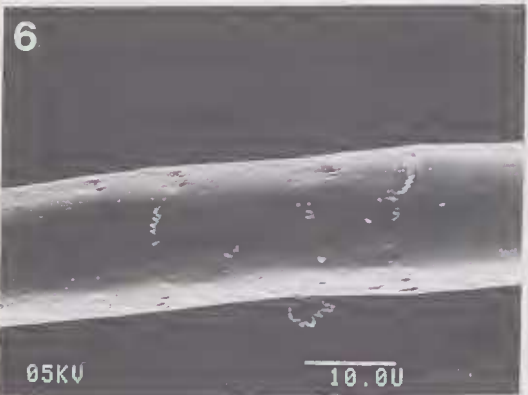
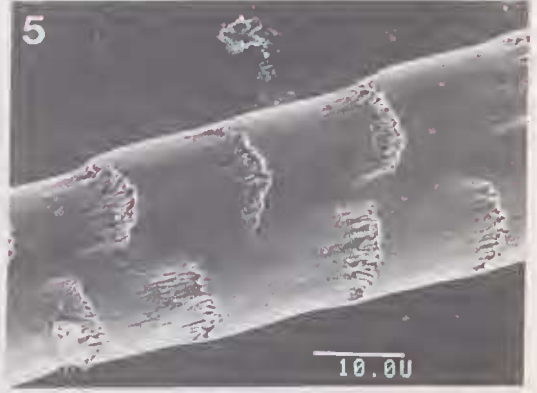
The worms produce large columnar cast accumulations up to 25 cm in height and 12 cm in diameter (B. Wood, pers. comm.), rivalling the largest recorded in the Oligochaeta. Extensive surface casting is also known for *D. heteropora* Dyne in the Townsville region (A.V. Spain, pers. comm.) Dyne (1979) noted that the latter species was also geophagous and apparently adapted to a wet/dry climatic regime. Lee (1967) reported on the adaptive exploitation of soil microrelief for wet season survival by the large surface casting earthworm, *Pheretima tumulifaciens* Lee, in New Guinea, but this phenomenon has not been investigated in the Acanthodrilinae. The prolific casting activity of *D. planumfluvialis*, its seasonality, and its pedological and adaptive significance are aspects currently under investigation (B. Wood, pers. comm.). The ability of *D. planumfluvialis* to survive a floodplain habitat with a monsoonal climatic regime may be at least partially due to its geophagous, rather than phytophagous, dietary mode and an amphibious propensity, a feature shared by a number of its eastern Australian congeners (Dyne 1984).

Diploptrema socialis sp.nov.
(Figs 3, 7-9)

Type material. HOLOTYPE - NTM Wo6, Upper Adelaide River Experimental Station, Adelaide River Floodplain, 131°14'E, 13°05'S, Northern Territory, solodic (Dy3.63) soil, collector B. Wood, 8 March 1984. PARATYPE - NTM Wo7, 1 semimature specimen, data as in holotype.

Additional material. Immature specimens, data as in type material (author's collection).

External anatomy. l=52, 47 mm; w=1.5, 1.1 mm; s=103, 105 (H, P1). Prostomium epilobous 1/2, closed. Body uniform in diameter throughout, but segments of the caudal extremity much reduced in size and compressed longitudinally. First dorsal pore not demonstrable with certainty (?absent). Setae



Figs 4-9. *Diploptrema* spp., mature setae: 4, penial seta of *D. planumfluvialis*, holotype; 5, detail of shaft; 6, penial seta of *D. planumfluvialis*, paratype 1; 7, penial seta of *D. socialis*, holotype, right XVII follicle; 8, penial seta of *D. socialis*, holotype, right XIX follicle; 9, genital seta of *D. socialis*.

closely paired throughout, ventral setal couples present in XVIII, modified as penial setae in XVII and XIX, and as genital setae in VIII. Clitellum not developed in the specimens examined.

Male field a simple, rectangular depression extending from mid XVII to 19/20; the porophores situated at the edges of this concavity, atop small, but definite papillae. The porophores of a side joined by ill-defined seminal grooves that traverse the raised lateral rims of the male field. Male pores not demonstrable.

Female pores a minute pair of presetal slits in XIV; spermathecal pores indistinct, in 7/8 and 8/9, aligned with the ventral setal pairs. No accessory markings present.

Internal anatomy. Only septal partitions 8/9-10/11 show any degree of muscularization; 6/7 and 7/8 somewhat thickened, as is 11/12, the remainder thin. Dorsal blood vessel single throughout. Last hearts in XIII. A supra-oesophageal vessel present from mid-VIII to XIII; the major commissurals (i.e. those in X-XIII) appear to be exclusively connected to the supra-oesophageal vessel, having no communion with the dorsal vessel. Anterior commissurals certainly dorso-ventral, but their continued association with the supra-oesophageal not certain. Gizzard, in V, moderately large and shiny, with obvious

proventriculus; oesophagus moniliform, vascular, in VI-XV. Intestine commences abruptly in XVI, broadening to maximal width by the succeeding segment; typhlosole lacking.

Ingesta: fine soil particles, silica grains and some blackened organic remains.

Holonephric; anterior tufted nephridia absent. In the intestinal segments, the coils of each nephridial body enveloped in ?connective tissue, giving the units a wafer-like appearance. Nephridial ducts uniformly enter the parietes in *d*-lines.

Holandric; 2 pairs of small, weakly iridescent spermathecal funnels present in X and XI, with finely loculate seminal vesicles seen in IX and XII. Vasa deferentia not traceable. Prostatic glands tubular; long, sinuous and delicate, anterior pairs extending posteriorly through septal walls into segments XXI or XXII; posterior pairs somewhat shorter, extending to XXII. Prostatic ducts narrow, hardly muscular. Both pairs of organs associated with penial seta follicles that penetrate into succeeding segments. The latter are joined to the prostates by diaphanous connective tissue, and to the body wall by limited copulatory musculature. The reddish setae ornamented over distal half with a variable number of fairly long, acuminate spines projecting at an acute angle to the setal shaft; these are interspersed with short circumfer-

Table 1. Intersetal ratios in segment XII for *Diploreta planumfluvialis* and *D. socialis*, expressed as percentages of the total circumference (U).

| | <i>D. planumfluvialis</i> | | | | | | | | U(mm) |
|------------|---------------------------|-----|------|-----|------|-----|------|-----|-------|
| | aa | ab | bc | cd | dd | dc | cb | ba | |
| H(NTM Wo1) | 10.1 | 1.7 | 16.9 | 1.4 | 49.7 | 1.5 | 16.9 | 1.8 | 27.4 |
| P(NTM Wo2) | 10.3 | 1.9 | 19.3 | 1.3 | 46.9 | 1.3 | 17.1 | 1.8 | 21.1 |
| P(NTM Wo4) | 10.0 | 2.0 | 18.1 | 1.2 | 49.4 | 1.3 | 16.2 | 1.9 | 25.8 |
| mean | 10.1 | 1.9 | 18.1 | 1.3 | 48.6 | 1.4 | 16.7 | 1.8 | 24.8 |
| | <i>D. socialis</i> | | | | | | | | U(mm) |
| | aa | ab | bc | cd | dd | dc | cb | ba | |
| H(NTM Wo6) | 10.9 | 3.8 | 13.1 | 4.4 | 45.7 | 3.5 | 15.2 | 3.5 | 4.5 |
| P(NTM Wo7) | 9.6 | 3.1 | 12.9 | 3.1 | 52.5 | 2.8 | 13.1 | 2.8 | 5.3 |
| Immature | 9.8 | 3.1 | 14.4 | 3.8 | 47.1 | 3.9 | 14.3 | 3.6 | 4.6 |
| mean | 10.1 | 3.3 | 13.5 | 3.8 | 48.6 | 3.4 | 14.2 | 3.3 | 4.8 |

rential bracts of irregularly jagged teeth. Latter ornamentation may predominate in some setae (Fig. 7), but some spines always present.

Ovaries not seen, but small, plicate oviducal funnels present in XIII. Spermathecae 2 pairs in VIII and IX, subequal, consisting of a lobulated, sacciform ampulla joining diverticulum/duct axis at 45°, and a short, blunt diverticulum iridescent with inseminate leading directly to a short duct. Length right spermatheca of VIII=0.9 mm. Genital seta follicles present in VIII only. Setae (Fig. 9) sculptured by regularly and closely disposed deep, axially directed excavations. Apical portion of seta swollen, terminating in a rounded point.

Remarks. The spinose penial setae of *D. socialis* are reminiscent of those seen in *D. mantoni* Jamieson and Dyne, as is the construction of the spermathecae. In other respects (genital markings, typhlosole, position of seminal vesicles, length of prostates, position of nephropores) the two species exhibit little affinity. It is noteworthy, however, that the Manton River (from which the latter species was collected) joins the Adelaide River only some 40 km northwards (downstream) from the type-locality of the two new species. *D. socialis* is also placeable in the *D. shandi* species-group.

ACKNOWLEDGEMENTS

I am grateful to Mr Blair Wood, of the Conservation Commission of the Northern

Territory, for providing the material that formed the basis of this study, as well as information on the casting phenomenon. Production of the micrographs would not have been possible without the kind co-operation of Mr Wally Goydych and the facilities of the Electron Microscope Unit, Bruce College of Technical and Further Education.

REFERENCES

- Dyne, G.R. 1978 A new species of *Microscolex* (*Diploptrema*) (Annelida: Oligochaeta) from New South Wales. *Proceedings of the Linnean Society of New South Wales* **103**(1): 37-41.
- Dyne, G.R. 1979 A new species of bioluminescent earthworm from north Queensland belonging to the subgenus *Diploptrema* (Oligochaeta: Megascolecidae). *Memoirs of the Queensland Museum* **19**(3): 373-379.
- Dyne, G.R. 1984 Systematics and Zoogeography of Australian Megascolecoid Earthworms. Ph.D. Thesis, University of Queensland: Brisbane.
- Jamieson, B.G.M. 1974a Generic type-species and other Megascolecidae (Annelida, Oligochaeta) in the Museum of Systematic Zoology, University of Turin. *Bollettino del Museo di Zoologia dell'Universita di Torino* **8**: 57-88.
- Jamieson, B.G.M. 1974b The indigenous earthworms of Tasmania. *Bulletin of the British Museum of Natural History (Zoology)* **26**(3): 203-328.
- Jamieson, B.G.M. and Dyne, G.R. 1976 The Acanthodriline Earthworm Genus *Microscolex* (*Diploptrema*) (Megascolecidae: Oligochaeta) in the Northern Territory of Australia. *Australian Journal of Zoology* **24**: 445-76.
- Lee, K.E. 1967 Microrelief features in a humid tropical lowland area, New Guinea, and their relation to earthworm activity. *Australian Journal of Soil Research* **5**: 263-74.

Accepted 9 February 1987